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PRELIMINARY REVIEW OF TRAINING MATERIALS

by

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PRELIMINARY REVIEW OF TRAINING MATERIALS

ABSTRACT

This report describes a research project which developed a methodology to evaluate the effectiveness of AECB licensee training materials. In addition, the professional resources required were identified and the costs of the total study and its constituent sections were estimated.

RÉSUMÉ

Le présent rapport décrit un projet de recherche pour mettre au point une méthodologie permettant d'évaluer l'efficacité de certains textes utilisés dans les cours offerts par les titulaires de permis dela CCEA. Les ressources professionnelles requises et le coût total du projet ont été déterminés.

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RESEARCH PROJECT (34-2-164-1): PRELIMINARY REVIEW OF TRAINING MATERIALS

A. INTRODUCTION

1. Overview

This report describes an AECB research project that was developed to provide an external review of certain training materials used in the training of nuclear power plant operators. The need for such a review arose from concerns that AECB authorities, responsible for the maintenance of training standards, expressed about the form and content of certain licensee training materials. Those materials appeared to impede rather than enhance training effectiveness.

2. Project Scope

Research Project 34-2-164-1 directed the Contractor to review a sample of AECB licensee training materials that would be supplied by the AECB to the Contractor. The Contractor would then be required to prepare a written report that would contain the following:

2.1 an outline of the methodology proposed by the Contractor that will discover and describe deficiencies that are detrimental to the training and learning effectiveness, and that may be present in all of the licensee's training materials;

2.2 a detailed estimate of the
- 2.1.1 number of person hours,
- 2.1.2 rate or rates per hour and qualifications for each person required, and
- 2.1.3 the cost of all other expenses

that would be needed to carry out the work described in the outline of the methodology proposed in paragraph (a).

B. ANALYTICAL GRID METHODOLOGY FOR THE ASSESSMENT OF AECB LICENSEE TRAINING MATERIALS

1. Overview

The following describes a methodology that requires the use of a conceptual tool called an analytical grid which is designed to discover and describe deficiencies in any and/or all of the licensee's training materials. An analytical grid methodology has the added advantage of identifying those aspects of the licensee's training materials which appear to be the most effective in promoting training and learning effectiveness. The analytical grid procedure sets the rules for a critical analysis of selected written course materials used by Ontario Hydro in the training of Nuclear Power Plant Operators.

2. Project Goals

The goals of this critical analysis would be to discover and describe any deficiencies in the course materials that are likely to be detrimental to training and learning effectiveness. Those goals will be attained by answering the following questions:

2.1. What is to be taught ?
2.2. Why should it be taught ?
2.3. How will it be taught ?
2.4. How will we know if what has been taught is learned ?
2.5. What materials and procedures will provide the most effective opportunities for teaching and learning ?

3. Project Objectives

Answers to these basic questions would require the critical evaluation of the selected courses and their individual modules; using an analytical grid designed to assess the relative presence or absence of the following:

- 3.1 Clearly identified course and module goals,
- 3.2 Clearly specified intermediate and terminal performance objectives,
- 3.3 Appropriateness of course content selected,
- 3.4 Appropriateness of course presentation procedures selected,
- 3.5 Appropriateness of teaching/learning methods selected,
- 3.6 Appropriateness of attainment evaluation procedures,
- 3.7 Redundancies and inconsistencies in the presentation of the same topic in different courses or in different levels of the same course.

Note:
It is recommended that "appropriateness" be evaluated in accordance with principles of learning and teaching which reflect good practise in the design and development of curricula and materials. "Appropriateness" should also be evaluated in terms of the cognitive and psychological load placed on the student by the sequencing of materials and procedures selected.

C. REPORT ON PILOT REVIEW

1. Pilot Review Findings

In order to assess the appropriateness of the analytical grid methodology a pilot review of a sample of Ontario Hydro's training course materials was undertaken. That excercise supports the contention that the proposed methodology has the range and scope required to successfully complete a comprehensive review of the AECB licensee's training courses.

The pilot review also shows that the licensee's training courses all suffer to a greater or lesser extent from certain form and content deficiencies. The following paragraphs identify some of those deficiencies and offer some suggestions arising from the results of a brief analytical grid assessment of selected course materials.

The most significant deficiency afffecting all course material reviewed is the absence of an overall course program plan which clearly states training goals. As the material is currently presented those training goals must be inferred from the explicit statement of course objectives and enabling objectives. That is, students are usually told **what** they are expected to do but only rarely are they told **why**.

The absence of a unifying overall plan usuallly makes the objectives appear to be somewhat arbitrary. The difficulties arising from this are usually compounded by a lack of cohesiveness in the text and the absence of connecting links between the modules of a given course. Related problems arise from the fact that connections between course objectives and course materials are not always readily apparent.

In fact, it sometimes appears that course objectives were written to conform to the content of existing courses rather than as precise statements of specific training goals established through training needs analyses. In this matter the analytical grid approach reveals that the presentation of the licensee's course materials appears to violate a basic tenet of the systems approach to training. The systems approach requires an explicit linking of needs analysis procedures to course delivery procedures - including goal statements and derived objective statements. This does not appear to have been done.

Less significant but no less troublesome deficiencies arise from the structure and content of courses reviewed. With some exceptions those materials are, for the most part, poorly written and ineffectively presented. For example, text tone and pace is often uneven and ambiguities resulting from unclear or poorly organized explanations are not uncommon.

2. Pilot review recommendations

It is suggested that it is wasteful of time and energy to expect students to undertake the self study of the courses which have been briefly reviewed. As presented those courses clearly call for the active participation of an instructor in order to optimize the efficiency of training time. A knowledgeable instructor would be able to make those all-important asides which make courses meaningful. As presented the course materials reviewed appear to be inadequate if they are intended to serve as self study lessons. They would probably be very good as lecture notes - if they were used by an effective instructor.

In the event that the course material reviewed is to be used as an adjunct to the formal presentation of effective lectures there appears to be some danger that students using the course material as study notes are likely to be confused by ambiguities and inconsistencies in the text which may or may not be congruent with the explanations provided by competent instructors.

D. IDENTIFICATION OF COURSES TO BE EVALUATED, PROFESSIONAL RESOURCES REQUIRED, AND ESTIMATES OF HOURLY RATES

1. Courses to be evaluated

The following presents estimates of the costs of procedures and resources required to carry out a critical evaluation of:

1.1 Course 225 Heat and Thermodynamics,
1.2 Course PI 36A, Instrumentation and Control Principles,
1.3 Course PI 36B Instrumentation and Control Practise.

2. Evaluation of Course 225 Heat and Thermodynamics

Completing a critical analysis of Course 225 will require the evaluation of related courses in order to establish how their content affects the terminal performance of students taking Course 225. Those courses are:

2.1 425 Heat and Thermodynamics;
2.2 325 Heat and Thermodynamics;
2.3 PI 25; Instrumentation
2.4 228 Materials;
2.5 233 Reactor, Boiler and Auxiliaries.

3. Evaluation of Course PI 36A Instrumentation and Control Principles

Completing a critical analysis of Course PI 36A will require the evaluation of related courses in order to establish how their content affects the terminal performance of students taking PI 36A. Those courses are:

3.1 4/330.3 Instrumentation Equipment;
3.2 PI 30.3 Instrument Equipment.

4. Evaluation of Course PI 36B Instrumentation and Control Practise

Completing a critical analysis of Course PI 36B will require the evaluation of related courses in order to establish how their content affects the terminal performance of students taking PI 36B. Those courses are:

4.1 PI 36A (pre-requisite);
4.2 PI 33 (co-requisite);
4.3 Course 433 Reactor, Boiler and Auxillaries;
4.4 Course 233 Reactor, Boiler and Auxillaries.

5. Professional resources required and estimated rates

It is recommended that persons having the skills and expertise listed below should comprise the evaluation team directed to complete a critical analysis of Course 225, Course PI36 A and Course PI 36 B. The following presents an estimate of what the Per Diem rates are likely to be for the personnel identified. It is suggested that Per Diem rates should be considered to be all-inclusive fixed price rates.

5.1 Principle Investigator (PI)

The prinicipal investigator should be a Learning and Instruction Specialist with experience in the evaluation of teaching programs. It is estimated that the services of such a person could be obtrained for $460.00 per diem (all inclusive).

5.2 Associate Investigator (AI)

The associate investigator should be a Curriculum Design and Implementation Specialist with experience in the evaluation of teaching programs. It is estimated that the services of such a person could be obtrained for $440.00 per diem (all inclusive).

5.3 Research Assistant (RA)

The services of a research assistant with an undergraduate degree in Science would accelerate the classification and coordination of the content of all course documents thereby expediting the work of the PI and the AI. It is estimated the services of such a person could be obtained for $125.00 per diem (all inclusive).

5.4 Hourly Rate Equivalents

Since Per Diem rates will be calculated on the basis of a full seven and one-half hour working day corresponding hourly rates are: PI rate = $61.33; AI rate = $58.66; RA rate = $16.66.

Table 1. PROJECT 225 EVALUATION OF COURSE 225 HEAT AND THERMODYNAMICS

A. TASK	PERSON DAYS REQUIRED PI	AI	RA
1. Complete a critical analysis of Course 225 Heat and Thermodynamics.	9	5	3
2. Complete a critical analysis of those parts of Course 425 Heat and Thermodynamics which affect student performance on Course 225.	4	2	2
3. Complete a critical analysis of those parts of Course 325 Heat and Thermodynamics which affect student performance on Course 225.	4	3	2
4. Complete a critical analysis of those parts of Course PI 25 Heat and Thermodynamics which affect student performance on Course 225.	4	2	1
5. Complete a critical analysis of those parts of Course 228 Materials which affect student performance on Course 225.	2	2	2
6. Complete a critical analysis of those parts of Course 233 Reactor, Boiler and Auxiliaries which affect student performance on Course 225.	2	2	2
7. Visit ENTC and WNTC	4	-	-
Total person days required	29	16	10

Principal Investigator - 29 days @ $460.00 Per Diem $13,340.00

Associate Investigator - 16 days @ $440.00 Per Diem ..... $ 7,040.00

Research Assistant - 10 days @ 125.00 Per Diem ..... $ 1,250.00

Estimated expenses ENTC, WNTC visits ..... $ 500.00

TOTAL COSTS FOR COURSE 225 EVALUATION **$22,130.00**

Table 2. PROJECT PI 36B EVALUATION OF COURSE PI 36B
INSTRUMENTATION AND CONTROL PRACTISE

A. TASK	PERSON DAYS REQUIRED PI	AI	RA
1. Complete a critical analysis of Course PI 36B Instrumentation and Control Practise.	9	4	3
2. Complete a critical analysis of those parts of Course PI36 A which affect student performance on Course PI 36B.	4	4	2
3. Complete a critical analysis of those parts of Course PI33 which affect student performance on Course PI 36B.	5	3	2
4. Complete a critical analysis of those parts of Course 433 Reactor, Boiler and Auxillaries which affect student performance on Course PI 36B.	3	1	1
5. Complete a critical analysis of those parts of Course 233 Reactor, Boiler and Auxillaries which affect student performance on Course PI 36B.	4	1	1
Total person days required	25	13	9

TOTALS

Principal Investigator - 25 days @ $460.00 Per Diem $11,500.00

Associate Investigator - 13 days @ $440.00 Per Diem ..... $ 5,720.00

Research Assistant - 10 days @ 125.00 Per Diem ..... $ 1,250.00

TOTAL FOR COURSE PI 36B EVALUATION **$18,470.00**

Table 3. PROJECT PI 36A EVALUATION OF COURSE PI 36A
INSTRUMENTATION AND CONTROL PRINCIPLES

A. TASK	PERSON DAYS REQUIRED PI	AI	RA
1. Complete a critical analysis of Course PI 36A Instrumentation and Control Principles.	10	5	5
2. Complete a critical analysis of those parts of Course 4/330.3 which affect student performance on Course PI 36A.	6	4	3
3. Complete a critical analysis of those parts of Course PI30.3 which affect student performance on Course PI 36A.	5	3	1
Total person days required	21	12	9

Principal Investigator - 21 days @ $460.00 Per Diem	$ 9,660.00
Associate Investigator - 12 days @ $440.00 Per Diem	$ 5,280.00
Research Assistant - 9 days @ 125.00 Per Diem	$ 1,125.00
TOTAL FOR COURSE PI 36A EVALUATION	**$16,065.00**

E. SUMMARY

In summary it is recommended that an analytical grid methodology be developed to provide the most appropriate and efficient means for discovering and describing deficiencies that are detrimental to the training and learning effectiveness, and that may be present in all of the licensee's training materials. Detailed estimates provided in the Tables 1, 2 and 3 show that if the work is to be completed according to recognized professional criteria, by the resources identified; then the three independent but related projects would require the following expenditures:

Total for Course 225 Evaluation	$22,130.00
Total for Course PI 36A Evaluation	$16,065.00
Total for Course PI 36B Evaluation	$18,345.00
GRAND TOTAL	**$56,540.00**